NJDOT DATA DRIVEN APPROACH TO TRAFFIC SIGNAL UPGRADES

By: New Jersey Department of Transportation

IN THIS CASE STUDY YOU WILL LEARN:
1. The New Jersey Department of Transportation (NJDOT) maintains and operates more than 2,500 signalized intersections.
2. NJDOT’s Transportation Mobility Division identified the need to develop a tool to both manage signal maintenance and their lifecycle.
3. Development of COAST-NJ has allowed signals to be grouped into zones and corridors, and then projects can be selected based upon analytical data.

BACKGROUND

The New Jersey Department of Transportation (NJDOT) maintains and operates more than 2,500 signalized intersections. The operation of those signals varies from isolated traffic signals having no coordination to an adaptive traffic signal system connected with fiber.

With the volume of traffic increasing along New Jersey highways, traffic signals become an important asset to assist in moving the traffic more efficiently and cost-effectively. But how does NJDOT best prioritize the optimization and upgrading of signalized intersections to more advanced systems? Without a management system in place, the process of scoring and prioritizing groups of signalized intersections (zones) could be random and inefficient.

NJDOT wanted to have a data-driven method to systematically identify desired upgrades of traffic signals managed by the state. The ITS Resource Center, managed by NJDOT’s Transportation Mobility Division, conducted the initial analyses that incorporated a variety of factors such as volume, capacity, roadway type, intersection spacing, and established a basic ranking approach. The intent was to create not only a management system but also a means to identify a long-term capital investment program for funding signalized intersection upgrades over 10+ years, and incorporated it into the Statewide Transportation Improvement Program (STIP) so that highly-ranked projects and funding could be matched and programmed into construction. This management system, used for strategic and systematic improvements of the signals on NJDOT’s signalized arterials, became known as Classification of Arterial System Technology for New Jersey (COAST-NJ).

TSMO PLANNING, STRATEGIES, AND DEPLOYMENT

A key product of that research and planning effort was the development of an analytical tool which included both quantitative and optional qualitative factors so that all highway segments could be evaluated by the same criteria statewide. This analytical tool assists in prioritizing the segments and what type of signal improvements are recommended. The beginning of the process involved obtaining the inventory of the traffic signal systems owned, operated, and maintained by NJDOT. This was the baseline that identified technology and assets installed and operated at signalized intersections from the control and communication technology perspective. Each signalized
intersection was identified based upon its current level of function and categorized into six tiers reflecting the type of system present. The highest level was an adaptive system and the lowest was an isolated signal with no coordination.

The next step involved other management systems within NJDOT. One of the systems was the Statewide Intersection Analysis Process (SIAP) which performs intersection capacity and performance analysis for each intersection using Highway Capacity Software. The SIAP score for an intersection is based on its underlying characteristics, such as lane configuration, movements, and traffic volume. The New Jersey Congestion Management System and the Straight Line Diagrams database provide input into the SIAP. After the SIAP analysis and scoring, the intersections were grouped into zones and further into “arterial corridors” (groups of zones). The grouping looked at proximity of individual intersections and the similarities in terms of traffic flow characteristics. Each corridor received a signal corridor composite score which indicates the potential for improving corridor operations by improving traffic signal control.

Upon completion of the development of this tool, NJDOT requested supplemental assistance to add functionality such as factor weight scoring adjustments based on local knowledge of the traffic signals, and signalized intersection improvement recommendations. The improvement recommendations have been simplified to either CTSS (adaptive systems) or timing optimization. In general, signals that were placed in Tiers 4, 5, and 6 (non-systems) are now recommended for timing optimization improvements. The rest of the signals placed in Tiers 1, 2, and 3 (systems) are generally recommended for adaptive system improvements. This simplifies the project scoping and design. The analysis tool also allows one to sort the results by route, county, municipality, and Metropolitan Planning Organization (MPO).

These initial results were further refined through the ITS Resource Center in building a management system to assist in the development of a statewide signal improvement program over a 10-year period.

Communications Planning and Execution

COAST-NJ has now been integrated into the NJDOT Enterprise Data Warehouse (EDW). The EDW supplies downstream reporting and planning applications that NJDOT staff use for various purposes.

Outcomes, Learnings, and Public Benefits

Development of COAST-NJ has allowed signals to be grouped into zones and corridors, and then projects can be selected based upon analytical data. This provides logic and accountability when scoping and designing projects.

The COAST-NJ management system has improved how NJDOT scopes and designs projects to include the needed ITS infrastructure based upon COAST-NJ analysis of future signal improvements.